

REMARKS

Claims 4-5, 9, 11-12, 16, and 18 are cancelled; thus, claims 1-3, 6-8, 10, 13-15, 17, and 19-20 are all the claims pending in the application. Claims 1-3, 5-10, and 12-20 stand rejected on prior art grounds. Applicants respectfully traverse these rejections based on the following discussion.

I. The Prior Art Rejections

Claims 1-3, 5-10, and 12-20 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Fuji (U.S. Patent No. 5,574,280) and Nikoonahad (U.S. Patent No. 6,633,831), in view of Berger (U.S. Publication No. 2004/0065826). Applicants respectfully traverse these rejections based on the following discussion.

The claimed invention provides a method of inspecting topographical features of a top layer of a structure. The method begins by surrounding the structure with a precursor metal gas. Next, an angled electron beam is directed at the structure to create secondary electron beams as the angled electron beam strikes sidewalls of the topographical features. The secondary electron beams break down the precursor metal gas to form a metal coating on the structure. Following this, an ion beam is directed at the structure to form a groove within the top layer of the structure. The method then inspects the topographical features exposed by the groove in the top layer of the structure.

In the rejection, the Office Action argues that the prior art of record discloses may features of the claimed invention. However, neither Fujii nor Nikoonahad teaches directing an *angled* electron beam at a structure at an angle sufficient to cause the electron beam to strike the sidewalls of the topographical features and *prevent the electron beam from reaching the bottom of the topographical features* (independent claims 1, 8, and 15). Although, Nikoonahad discusses how implantation of ions may cause damage and lists factors that determine the extent of the damage, the *angle* of the ion implantation is not disclosed as a factor. Moreover, Fujii uses a *direct* (not secondary) electron beam to form a metal coating, wherein Fujii is not concerned about damaging delicate components underlying the sample surface. Therefore, as explained in

greater detail below, Applicants respectfully submit that the prior art of record does not teach or suggest the claimed invention.

Applicants traverse the rejections because the prior art of record fails to teach the claimed features of directing an *angled* electron beam at a structure at an angle sufficient to cause the electron beam to strike the sidewalls of the topographical features and *prevent the electron beam from reaching the bottom of the topographical features*. Such features are defined in independent claims 1, 8, and 15 using similar language.

More specifically, Fujii uses metal gas and a *direct* (not secondary) electron beam to form a metal coating. Fujii is silent as to the angle of the direct electron beam. Thus, Applicants submit that Fujii is not concerned about damaging delicate components underlying the sample surface.

To the contrary, as discussed in paragraph 0028 of Applicants' disclosure, the secondary electron beams 604 break down the precursor metal gas to form a metal *coating* 112, without damaging the top layer 102 (or underlying layers 100). This process directs the electron beam 110 at an angle sufficient to cause the electron beam 110 to strike only the sidewalls of the vias 104 and prevent the electron beam 110 from reaching the bottom of the vias 104, so as to not damage the vias 104 during the metal formation process. The primary electron beam 110 does not substantially affect the sidewalls of features and can readily be directed at such sidewalls. Instead, the primary beam should be kept away from the bottom and lower level features, such as the ARC, to prevent damaging such lower level substances.

In addition, Applicants submit that Nikoonahad discusses how implantation of ions may cause damage and lists factors that determine the extent of the damage -- "energy of the ions", "the species of ions being implanted or the implant dose", "optical property of the masking material", and "thickness and a lattice structure of the upper crystalline layer and the amorphous layer". Nevertheless, the *angle* of the ion implantation is not disclosed as a factor.

Moreover, although Nikoonahad mentions “secondary electrons”, they are not utilized for forming a *coating* (metal or otherwise). Instead, the secondary electrons of Nikoonahad are utilized for *imaging* a specimen.

To the contrary, as discussed in paragraph 0034 of Applicants’ disclosure, having the direct electron beam reach the bottom of the contact hole should be avoided. There are two reasons for this. First, the ARC layer, which underlies the resist and is exposed at the bottom of the contact hole, can be easily damaged by the direct beam during deposition process because of the existence of the precursor gas. Secondly, the damaged ARC material can be sputtered away from the bottom and redeposited on the sidewall of the contact hole, to blur or distort the profile of the contact hole sidewall in the final SEM image.

As further discussed in paragraph 0035 of Applicants’ disclosure, the optimal angle of the incoming direct beam will be dependent on the aspect ratio of height to diameter of the contact. The beam should be angled so that the direct beam does not hit the bottom of the contact hole. If the angle of the beam is 90 degrees (perpendicular to the surface) the metal deposition rate is the highest, but the damage to the resist profile is also the highest. If the beam is zero degrees (parallel to horizontal surface of the contact), there will be no metal deposition inside the contact hole, with zero damage to the profile. The best angle will have a reasonably rapid and uniform metal deposition with minimized damage to contact profile. For example, the angle could be around 45 degrees (in the range of 70 degrees to 20 degrees).

Accordingly, Applicants submit that the prior art of record does not direct an *angled* electron beam at a structure at an angle sufficient to cause the electron beam to strike the sidewalls of the topographical features and *prevent the electron beam from reaching the bottom of the topographical features*. Instead, Fujii uses a *direct* (not secondary) electron beam to form a metal coating, wherein Fujii is not concerned about damaging delicate components underlying the sample surface. Furthermore, although, Nikoonahad discusses how implantation of ions may cause damage and lists factors that

determine the extent of the damage, the *angle* of the ion implantation is not disclosed as a factor.

Therefore, it is Applicants' position that Fujii fails to teach the claimed features of "directing an angled electron beam at said structure where an angle of said angled beam is selected to create secondary electron beams as said angled electron beam strikes sidewalls of said topographical features, comprising directing said electron beam at an angle sufficient to cause said electron beam to strike the sidewalls of said topographical features and prevent said electron beam from reaching the bottom of said topographical features, wherein said secondary beams have less energy than said angled electron beam" as defined in independent claims 1, 8 (wherein the "the "structure" is a "partially completed integrated circuit structure"; and, wherein the "metal gas" is an "organic metal gas"), and 15 (wherein the "the "structure" is a "partially completed integrated circuit structure"; wherein the "metal gas" is an "organic metal gas"; and, wherein the "topographical features" of claim 1 are "vias").

Therefore, it is Applicants' position that the prior art of record does not teach or suggest many features defined by independent claims 1, 8, 15 and that such claims are patentable over the prior art of record. Further, it is Applicants' position that dependent claims 2-3, 6-7, 10, 13-14, 17, and 19-20 are similarly patentable, not only because of their dependency from a patentable independent claims, but also because of the additional features of the invention they defined. In view of the foregoing, the Examiner is respectfully requested to reconsider and withdraw the rejections.

II. Formal Matters and Conclusion

In view of the foregoing, Applicants submit that claims 1-3, 6-8, 10, 13-15, 17, and 19-20, all the claims presently pending in the application, are patentably distinct from the prior art of record and are in condition for allowance. The Examiner is respectfully requested to pass the above application to issue at the earliest possible time.

Should the Examiner find the application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at the local telephone

number listed below to discuss any other changes deemed necessary. Please charge any deficiencies and credit any overpayments to Attorney's Deposit Account Number 09-0458.

Respectfully submitted,

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